

MATH*1071*FAB: Vectors and Matrices

Fall 2022

Lectures: TTh 09:30-11:00
Labs: M 14:00-16:00

Lecture Room: E013
Lab Room: M339

Instructor: Dr. George Hutchinson
Office Hours: T 14:00-15:00
Th 13:30-14:30

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Course Summary

Areas of study include: Cartesian coordinates; vectors in two and three dimensions; the dot product and components of vectors; the cross product; equations of lines and planes; complex numbers; vector spaces over the real and complex number systems; linear independence; bases and spanning sets; subspaces; matrices; addition and scalar multiplication of matrices; matrix multiplication; the transpose of a matrix; invertible matrices; systems of linear equations and row reduction; and determinants, including Cramer's rule

See page 3-4 for a more detailed schedule of topics that we will be covering.

Course Materials

Website: This course uses a D2L (Courselink) site, on which grades and important course information will be posted. You are expected to check this website regularly for announcements and course materials.

(The website can be found at www.mycourselink.lakeheadu.ca.)

Required Textbook & Supplementary Material: There is no required textbook for this course. The course notes will be the primary source of information. Students who desire supplementary material are encouraged to use the (free!) online textbook that is available at the URL <http://linear.ups.edu/html/fcla.html>, or speak to me about alternative supplementary material.

Descriptions of Course Components

Lecture: While I will not be taking attendance, you are strongly encouraged to come to lecture. As there is no textbook for this course, lectures will be the primary source of material. As well, there will often be important information regarding assignments and tests conveyed in lecture.

NOTE: *Prior to each lecture, I will upload a document consisting of partially complete notes for that class. You are expected to bring these notes to lecture, and we will fill them in together.*

Lab: While the purpose of the lectures is to introduce new material and discuss mathematical theory, it is in the lab that we will apply the lecture material to solve problems. The notes from these sessions should prove invaluable to you as you work through your assignments and study for your tests and exam.

Assignments: There will be one online WeBWork assignment active from Thursday to Wednesday each week, except for Week 5, Week 8 (Fall Study Break), and Week 14. While there is a total of 11 assignments, only your best 10 assignments will be graded. A link to WeBWork can be found on our course website, under "Content".

NOTE: *I am dropping your lowest two assignment marks to account for one missed assignment. If more than one assignment must be missed for a legitimate reason (e.g. Illness), the weight of the assignment(s) will be added to the final exam. **Under no circumstances will late assignments be accepted!***

Term Tests: There will be two Term Tests, written during Lecture. These are scheduled for **October 05** and **November 08**. Test #1 will cover Weeks 1-4, and Test #2 will cover Weeks 1-9, with a strong emphasis on weeks 5-9.

NOTE: *If a term test is missed for a legitimate reason (e.g. Illness) the weight of the test will be added to the final exam.*

Final Exam: There will be a cumulative final exam, the date and time of which will be announced as soon as it is scheduled.

Course Schedule:

We will adhere to the following schedule of topics to the best of our abilities. It may be subject to minor changes due to unforeseen delays and/or expedition.

Week	Topics Covered	Evaluation
W1 Sept 05 – Sept 09 (Classes begin Sept 06)	<u>Introduction to Vectors:</u> Vectors in Two and Three Dimensions; The Dot Product and the Cross Product	WeBWork Assignment 1 active Sept. 08 – Sept. 14
W2 Sept 12 – Sept 16	<u>Introduction to Vectors:</u> Equations of Planes and Lines in Three dimensions <u>Euclidean m-space:</u> Orthogonality; Magnitude/norm; Subspaces	WeBWork Assignment 2 active Sept.15 – Sept. 21
W3 Sept 19 – Sept 23	<u>Euclidean m-space:</u> Linear Independence; Span; Bases and Dimension	WeBWork Assignment 3 active Sept.22 – Sept. 28
W4 Sept 26 – Sept 30	<u>Euclidean m-space:</u> Orthonormality and the Gram-Schmidt Process <u>Vector Spaces:</u> Definition of a Real Vector Space; Introduction to the Space of Matrices; Inner product spaces	WeBWork Assignment 4 active Sept. 29 – Oct. 05
W5 Oct 03 – Oct 07	<u>Vector Spaces:</u> Introduction to Complex Numbers and Complex Vector Spaces	Term Test #1: In class October 04. (No Assignment This Week)

<p style="text-align: center;">W6 Oct 10 – Oct 14 (No classes Oct. 10th due to Thanksgiving)</p>	<p><u>Matrices and Linear Systems:</u> Basic Matricial Definitions and Operations; Matrix Inversion and its application to Linear Systems</p>	<p>WeBWork Assignment 5 active Oct. 13 – Oct. 20</p>
<p style="text-align: center;">W7 Oct 17 – Oct 21</p>	<p><u>Matrices and Linear Systems:</u> Gauss-Jordan Elimination; Rank and Nullspace; The Rank-Nullity Theorem</p>	<p>WeBWork Assignment 6 active Oct. 20 – Nov. 02</p>
<p style="text-align: center;">W8 Oct 24 – Oct 28</p>	<p style="text-align: center;">STUDY WEEK ENJOY THE BREAK!</p>	<p style="text-align: center;">None</p>
<p style="text-align: center;">W9 Oct 31 – Nov 04</p>	<p><u>Determinants:</u> Introduction to the Determinant and its Properties; Calculating the Determinant via Cofactor Expansion; Matrix Inversion and the Adjugate; Cramer’s Rule</p>	<p>WeBWork Assignment 7 active Nov. 03 – Nov. 09</p>
<p style="text-align: center;">W10 Nov 07 – Nov 11</p>	<p><u>Eigenvalues and Eigenvectors:</u> Introduction to Eigenvalues and Eigenvectors; The Characteristic Polynomial</p>	<p>WeBWork Assignment 8 active Nov. 10 – Nov. 16</p> <p style="text-align: center;">Term Test #2: In class November 08</p>
<p style="text-align: center;">W11 Nov 14 – Nov 18</p>	<p><u>Eigenvalues and Eigenvectors:</u> Properties of Eigenvalues; Eigenvalues of Special Matrices (Diagonal, Hermitian, Nilpotent, etc.); Introduction to Matrix Diagonalization; Matrix Similarity</p>	<p>WeBWork Assignment 9 active Nov. 17 – Nov. 23</p>

<p style="text-align: center;">W12 Nov 21 – Nov 25</p>	<p><u>Matrices as a Vector Space:</u> Subspaces of Matrices; Bases and Dimension of Matrix Spaces</p> <p><u>Linear Transformations:</u> Introduction to Linear Transformations; Representing Linear Transformations as Matrices in the standard basis</p>	<p>WeBWork Assignment 10 active Nov. 24 – Nov. 30</p>
<p style="text-align: center;">W13 Nov 28 – Dec 02</p>	<p><u>Linear Transformations:</u> The Relationship Between Matrix Similarity and Linear Transformations; Matrix Diagonalization revisited</p>	<p>WeBWork Assignment 11 active Dec. 01 – Dec. 06</p>
<p style="text-align: center;">W14 Dec 05 – Dec 09 (Classes end December 06)</p>	<p style="text-align: center;">Review for Final Exam</p>	<p style="text-align: center;">None</p>

Evaluation

Your final grade will be comprised of the following components, weighed as indicated:

20% Weekly Assignments (best 10 of 11, worth 2% each)

20% Term Test 1

20% Term Test 2

40% Final Exam

Course Learning Outcomes:

Upon successful completion of this course, the student will have demonstrated the ability to:

- Understand the basic geometry of lines and planes, finding points of intersection and identifying orthogonality.
- Competently discuss the concepts of linear independence, bases, and dimension.
- Apply the theory of inner products to complex vector spaces and construct orthonormal bases.
- Apply Gaussian-elimination to solve linear systems and calculate the inverse of a given matrix.
- Calculate determinants and apply these calculations to solve linear systems and perform matrix inversion.
- Use the characteristic polynomial to calculate the eigenvalues and eigenvectors of a given matrix.

Lakehead-Georgian Policies

Academic and Student Code of Conduct Policies:

- Academic and student policies and procedures for those enrolled in the Lakehead-Georgian programs can be found on the [Lakehead-Georgian Student Portal](#).
- All Lakehead-Georgian programs will follow the Lakehead Regulations as list in the Lakehead University [Academic Calendar](#) (<http://csdc.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&loaduserredits=False>). The University Regulations include but are not limited to Registration, Examinations, Reappraisals and Academic Appeals, Special Examinations, Academic Misconduct, Withdrawal, and Timely Feedback. Additional Faculty Regulations may also apply. Please review the Academic Calendar.
- The Lakehead University [Student Code of Conduct - Academic Integrity](#) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Lakehead University [Student Code of Conduct - Appeals](#) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Georgian College [Student Code of Conduct](#) (<http://www.georgiancollege.ca/student-code-of-conduct/>) will apply to the Lakehead-Georgian students studying at the Barrie campus. Additional campus policies of [Sexual](#)

[Violence Procedure and Protocol \(https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/sexual-violence\)](https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/sexual-violence), Alcohol, Drugs and Tobacco (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/alcohol-drugs-and-tobacco>), and [Information Technology Acceptable Use Procedure \(http://www.georgiancollege.ca/wp-content/uploads/2-117IT-acceptable-use.pdf\)](http://www.georgiancollege.ca/wp-content/uploads/2-117IT-acceptable-use.pdf) also apply.

- The Lakehead University [Student Code of Conduct – Non-Academic \(https://www.lakeheadu.ca/students/student-life/student-conduct\)](https://www.lakeheadu.ca/students/student-life/student-conduct) will apply to the Lakehead-Georgian students studying at the Orillia campus.

Plagiarism and academic dishonesty: A breach of Academic Integrity is a serious offence. The principle of Academic Integrity, particularly of doing one’s own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should view the [Student Code of Conduct -Academic Integrity \(https://www.lakeheadu.ca/students/student-life/student-conduct\)](https://www.lakeheadu.ca/students/student-life/student-conduct) for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

Student Services and Support

Student Advisors (<https://georgiancollege.sharepoint.com/sites/student/Student-Services/StudentAdvisors/SitePages/Home.aspx>)

- Help students build both academic and personal resilience so that they can flourish at Georgian and beyond
- Provide individual, group and web-based advising sessions
- Are housed within the academic areas
- To book an appointment with your advisor go to the **Student Portal (preferred)** or call **705-728-1968 Ext. 1307**

Library (<http://library.georgiancollege.ca/main>)

Customer Service

- Off campus access

Research help

- Help finding books, articles and credible sources.
- Using specialty databases.
- Creating a search strategy.

Academic Success (<https://library.georgiancollege.ca/help/contact-academic-success>)

Writing Centre (http://library.georgiancollege.ca/writing_centre)

- Improve your writing.

- Help with citing sources and laying out your paper.

Math Centre (http://library.georgiancollege.ca/math_centre)

- Make sense of math questions.
- Understand concepts and develop skills.

Tutors (<http://library.georgiancollege.ca/tutoring>)

- Further understand course content.
- Build your study practices.

Accessibility Services (<https://www.georgiancollege.ca/student-life/student-services/accessibility-services/>)

If you are a student experiencing a disability who may require academic accommodations and have not yet registered with Accessibility Services, please contact their office at 705-722-1523, email studentsuccess@georgiancollege.ca, or visit their offices in B110. You must be registered with Accessibility Services to access academic accommodations. Support for those students whose success at college may be affected by a disability include:

- Ongoing support from our Accessibility Advisors including arranging a confidential psychoeducational assessment where required
- Training in the use of specialized computer technology
- Classroom and test accommodations

Testing Services (<http://www.georgiancollege.ca/student-life/student-services/testing/>)

- Accommodated testing
- Missed/Makeup testing
- Proctoring services are also available for external and Ontario Learn exams

Counselling (<http://www.georgiancollege.ca/student-life/student-services/counselling/>)

- Free, confidential counselling is available to all students
- Walk in counselling is available on a daily basis Monday to Friday

Career Success (<http://www.georgiancollege.ca/student-life/student-services/co-op-and-career-services/>)

Career assessments and exploring options

- Job search workshops
- Labour market information
- Resume/cover letter help
- Interview practice
- Graduate employment information
 - Links to job postings and online resource

Campus Safety and Security Syllabus Addendum

Emergency Evacuation (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire>)

- Evacuate buildings when a fire alarm is activated or an official announcement is given. Review [evacuation guidelines](https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire). (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire>)
- Students requiring assistance in emergency situations must inform their faculty during the first week of class.
- Familiarize yourself with all fire exit doors of classrooms and buildings you may occupy.
- Do not re-enter a building until instructions are given by the Fire Department or college personnel.

Lockdown (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/lockdown>)

- Lockdown is initiated when there is a potential or actual violent incident on campus that could result in a serious injury or threat to life.
- Students can download the new Safe@Georgian app to stay updated on Campus Safety and Security information including lockdown.
- Familiarize yourself with the [College Lockdown procedure](https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf) (<https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf>)
- Lockdown tests occur each semester.

Resources:

- [Get Out, Hide, Fight Lockdown Video](http://youtu.be/JA8cckMbVDk) (<http://youtu.be/JA8cckMbVDk>)
- [Lockdown quick reference sheet](http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf) (http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf)
- Lockdown Model – Get Out, Hide, Fight: Lockdown Tools and Tactics and FAQs.

Unscheduled Campus Closure (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/campus-closures>)

Resources:

- [How to find out if your campus is closed](http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed) (<http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed>)
- [Unscheduled Campus Closure Procedure](https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf) (<https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf>)

Timing of Closures/Notification:

Closure	Decision	Communication / Notification*	Notes
College has made the decision to close a campus or location in the morning:	6:00 a.m.	By 6:30 a.m.	If re-opening for noon or evening classes is being considered, this will be mentioned in the message

College closes a campus(s) in the morning and <u>expects to re-open by 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	Only affects classes beginning at 12 noon or later
Closure expected to continue <u>past 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	
College intends to <u>re-open for evening classes</u> which commence at 5 p.m. or later	2:30 p.m.	By 3:00 p.m.	
College intends to <u>NOT re-open for evening classes:</u>	2:30 p.m.	By 3:00 p.m.	

***Notification will be made via:**

- Georgian social media (Facebook, Twitter)
- Safe@Georgian app
- Georgian website (homepage)
- Recorded message when you call into Barrie campus at 705-728-1968
- Student or employee portal
- Georgian email account
- Radio and television announcements through local and regional media

Note: We only announce the names of campuses that are closed. If your campus is not named in a closure, it's open.

